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ALBANIA

USE OF NUCLEAR TECHNOLOGY IN AGRICULTURE

Tirana SHKENCA DHE JETA in Albanian No 3, Mar 77 pp 17-19

[Article by Skender Malja, radiochemist in the Institute of Nuclear Physics]

[Text] From year to year, as a result of the party's special care, the productive forces and industrial and agricultural production have been constantly increasing, and in the stage that our country has reached, as Comrade Enver says, "we cannot move forward rapidly in any field without thorough scientific studies at present and in the prospective future..., and in particular, the establishment of modern agriculture requires organized and integrated studies by the farm specialists, but also by the workers in the biological, chemical, physical, mechanical and other sciences."

In this article we will try to give a picture of the use of radioactive isotopes in agriculture in general and of some first applications undertaken in our country.

The use of nuclear technology in agriculture consists in nuclear irradiations of different sorts or in the employment of artificial radioactive isotopes as tracers. In the former case, which is a very wide field and in which a good many encouraging successes have been achieved in our country, nuclear irradiations are used to preserve vegetable and animal food products, to stimulate seeds before planting in order to increase the yield of farm crops, shorten their vegetative cycle, create new varieties with desirable characteristics and so forth.

The use of radioactive isotopes in the tagged-atom method enables the student to observe the behavior of the elements or other compounds and their interaction with the soil or the plant, and to judge the role they play in developing the plant and the transformation they undergo during the different phases of its development. In all cases, exact information about the location of the radioactive isotope or the transformations that it undergoes is obtained from radiation discharged by the isotope. This radiation can be photographed (recorded on special radiographic film) or measured with the aid of electronic recording apparatus.

As a condition for obtaining effective results, the radioactive substance (the quantity of its activity) must not harm the normal life of plants and animals, since the use of high doses may be fatal to the plant, or may cause other disorders. Likewise, the radioactive isotope used must have a suitable half-life so that it will not be entirely spent by the end of the experiment.

Photosynthesis in rice has been studied with the aid of radioactive carbon C14. The study has shown that at the beginning of the development of rice, the process of photosynthesis takes place principally in the main body of the plant, whereas only 2-3 percent takes place in the branches. These data show that in the initial phase we do not have vigorous photosynthesis processes, whereas the later periods of development are more important. A similar law is also observed for wheat. It has been noted that the speed of movement of the products of photosynthesis was 0.6 cm/min. In 24 hours about 75 percent of the products of photosynthesis passes into the seeds, and only 5-7 percent remains in the leaves.

The studies show that in the growth phase wheat needs more phosphorus. When phosphate fertilizer is given the plant in this phase of development (that is, in spring), the wheat yield is increased 25 percent in comparison with the case where phosphorus is given in winter.

Of great economic value is the use of radioactive isotopes in fruit growing. To judge as quickly and accurately as possible the success expected from the grafting of fruit trees, the following action was taken: A suitable radioisotope was injected into the side of the scion where the graft had been made, and its movement was followed. If the radioactive isotope came out on the other side of the grafted scion, the graft was termed a success.

The first artificial isotope used in agrochemical experiments, but now occupying an important place in studies of agricultural problems, is radioactive phosphorus P32. This may be explained not only by the ease of procuring it and by its relatively long half-life, but also by the efforts being made to solve many practical problems relating to the phosphate feeding of plants and the use of phosphate fertilizer.

The use of phosphate fertilizers with radioactive tracers has produced other results concerning the phosphate feeding of plants. It was formerly thought that the phosphates in the soil were exploited by the plant in the same way whether fertilizer was used or in its absence.

Experimentation with radioactive phosphorus has made it possible to determine precisely the coefficient of the use of the phosphorus in the fertilizer. Formerly, it was believed the the coefficient of use of the fertilizer phosphorus by plants had to be relatively low, but this method of study has led to the conclusion that the degree of assimilation of phosphorus added to the soil in the form of fertilizer was greater than had been thought.

A very important problem for agricultural practice is the determination of the fertility of soil as to phosphosus; that is, the determination of the content of assimilable phosphorus in the soil. The task is performed by using radioactive phosphorus with a high specific activity. After selecting the type of soil, it is ground to specified dimensions, sifted and then sprayed with a radioactive solution of phosphorus. During the mixing of the soil an exchange of places (isotope exchange) occurs between the added radioactive phosphorus and the assimilable phosphates in the soil. When the plant begins to develop (that is, when it assimilates phosphorus), the relation between the quantity of nonradioactive phosphorus and the radioactive phosphorus assimilated by the plant will, of course, be the same as that between the quantities of them in the soil:

$$\frac{P_b}{P^{32}_b} = \frac{P_{as}}{P^{32}_t} \qquad \text{or} \qquad P_{as} = P_b \frac{P^{32}_t}{P^{32}_b}$$

where P_{as} = assimilable phosphorus in the soil, P^{32}_t = radioactive phosphorus added to the soil, P^{32}_b = the radioactive phosphorus assimilated by the plant, P_b = the total phosphorus assimilated by the plant.

By selecting suitable (fast developing) plants one can determine this value for different types of soil. Determination of the amount of assimilable phosphorus in the soil permits us to judge also the content of the phosphate nutrient reserve contained in that soil, which is a very valuable datum for the precise drafting of pedological maps. Determination of this value for several types of soil has also begun in our country.

The use of the tagged-atom method has facilitated to a considerable extent the observation of the rate of entry of nutrients from the fertilizer into the plant. It has been ascertained that the relation between the phosphates in the soil and the fertilizer absorbed by the plant during the vegetative period varies greatly. This relation is the same for all crops and depends upon the form of fertilizer, the dosage and the times and ways of adding it.

The interesting examples of the use of radioisotopes as tracers in agriculture are numerous, but we will dwell upon the description of some of the problems that the Nuclear Physics Institute has encountered in its collaboration with other enterprises and institutes.

Our country's leather industry uses chromium compounds during the technological process of skin tanning. After the tanning has been done, the chromium is thrown away by the factory as useless waste.

The workers of the botanical department of the Faculty of Natural Sciences have taken the initiative to use this waste as micro-fertilizer on various farm crops such as potatoes, cotton, sugar beets and so forth. But first it had to be tested scientifically, as chromium takes part in different

metabolic processes. It is practically impossible to determine these small traces of chromium either in the plant or in the soil by the usual method of chemical analysis. The only way to give an answer is to use chromium tagged with a suitable radioactive isotope. The chromium coming from the factory as waste has been tagged with radioactive chromium Cr51 with a suitable activity and has been used as raw material for the micro-fertilization of various crops.

It has been noted that in the crops used there is a perceptible assimilation of chromium, and this assimilation is more pronounced in the initial stage of the plant's development. Hence, the micro-fertilization should be done at the beginning of the planting.

We have mentioned above that radioactive tracers make it possible to judge the degree of assimilation of a given fertilizer by plants and to draw important conclusions for daily agricultural practice. Experimentation to determine the coefficient of utilization of the phosphorus in superphosphate by wheat and corn crops has been undertaken in cooperation with the Higher Agricultural Institute, and continues. The problem is rather complex and requires the solution of a series of tasks.

In performing this job, the first requirement was to tag with radioactive phosphorus the superphosphate produced by the Lac plant. The task was successfully fulfilled by using the isotope exchange method. The superphosphate tagged with radioactive phosphorus is quite similar as to physicochemical properties to the superphosphate used by agriculture, with the sole difference that the amount of phosphorus in the fertilizer can be recorded also with nuclear apparatus, which cannot be said of the ordinary superphosphate. Wheat and corn planted in vegetative pots have been fertilized with radioactive superphosphate, and the dynamics of the assimilation of the phosphorus in the fertilizer and in the soil in the various stages of development of those crops has been studied.

Quite promising also is the use of many other radioisotopes in our country. Modern agriculture cannot be conceived without vast use of chemical products. One aspect of this is the ever greater use of pesticides to combat farm pests. In general, it is acknowledged that the use of pesticides is a two-edged sword when used without scientific criteria.

The doubt about pesticides is due to the possibility that traces of pesticides or their derivatives which are known to be poisonous to the human organism may have adhered to farm products when harvested. This fact makes it necessary to determine the amount of pesticide residues in farm products and to make comparisons with the norms permitted for them by the health organs. In order to reach or keep under the permissible norms, the pesticides must be used correctly. This means that the doses of pesticides used must be determined and the interval of time needed for the pesticide to become harmless or for the concentration of it to be reduced to permissible

levels has to be ascertained. It is evident that these very intricate tasks are very hard to resolve by chemical analysis. In this case radioactive isotopes have the answer to the problem. In such cases it is necessary to synthesize the pesticide with one or more radioactive isotopes; for example, rogori, with the chemical formula $C_5H_{12}NO_3S_2P$, is tagged with S^{35}, P^{32} and Cl^{4} in certain positions of the molecule. The tagged pesticide permits us to follow its fate with relative ease in farm products or in the soil. It suffices to take samples from the farm products sprayed with this or from the soil and analyze them for radioactivity content.

Valuable aid will be rendered by the Institute for the study of many problems concerning the nitrogen nutrition of plants. In this case we no longer work with radioactive isotopes, but with the stable isotope of nitrogen, nitrogen-15, which is recovered artificially. Since nitrogenous fertilizers do not contain nitrogen-15, it is possible, with the aid of the mass spectrometer (an apparatus that distinguishes atoms with different masses), to distinguish natural nitrogen with atomic weight 14 from nitrogen tagged with atomic weight 15 and to draw various conclusions.

Of course, in the future the number of problems solved with the aid of radioactive isotopes will undoubtedly increase. The greatest prospects pertain to applications of isotopes in our socialist agriculture as well, in order to advance it still more on the course of intensification.

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ACADEMY HEAD DISCUSSES SCIENCE BUDGET, RESEARCH GOALS

Dresden SAECHSISCHE ZEITUNG in German 24 May 77 pp 3-4

[Edith Gierth and Hans Pietschmann interview with Prof Dr Hermann Klare, president of the GDR Academy of Sciences]

[Text] SAECHSISCHE ZEITUNG [SZ] By 1980 we will have spent M35 billion for science and technology. That is M10 billion more than in the previous five-year plan. Some readers ask if it is worthwhile to spend so much money on science.

Professor Klare: The answer to your question is easy for me because it can be found in CPSU Secretary General L. I. Brezhnev's address when he spoke with the presidents of academies of science in socialist countries who were gathered in Moscow. At that time he said: "Our country has an enormous scientific potential at its disposal. Anatoliy Petrovich (this is A. P. Alexandrov, president of the USSR Academy of Sciences) has probably informed you about the extent of expenditures for science in our country. They are in fact increasing, rapidly, in fact. But it seems to me the word "expenditures" is not quite exact in this connection. Because if we are talking about the work of genuine scientists and the study of problems that are of real scientific and economic interest, then the state and society derive "a considerable gain for every ruble spent." Now I would not care to hide behind the authority of the CPSU secretary general. Therefore, let me add that what L. I. Brezhnev said also holds for the GDR. The funds which we use for science and technology amount to a scant 5 percent of our national income. Of that about M3.5 billion are allocated for academy research in the period.

I feel we have every reason to be thankful to our party and state leadership for this far-sighted policy; because the role of science in scientific-technical progress is undisputed. I would not like to repeat here what was said in this regard at the ninth party congress and the ensuing plenary meetings of the Central Committee. Of course, an extra-ordinarily great responsibility is imposed on all scientists in the use of these substantial

financial means: outlay and use of research and development must be in proper balance with each other.

In order to be well understood I would like to answer your question with some additional examples: For the development of synthetic fibers from 1940 to the present many millions of marks have been spent throughout the world by way of research and development funds. Today, on a world scale, 45 percent of all fibrous materials used by the textile industry for clothing and household textiles, for technical fabrics and many others, consist of manmade fibers; today this means we would, for example, no longer be in any kind of position to clothe ourselves adequately if this research work had not been carried out to this extent, quite apart from other advantages of manmade fibers.

Five Rubles for One, and How About Here?

Something analogous to this can be demonstrated for plastics, and your readers surely know just as well as I do what we would not have today if polymer research had not been pursued and if it were not still being carried out. As an example, I would like to select something quite randomly: We would have no modern fishing gear, no domestic appliances made of polyethylene, no sailboats of fiberglass-reinforced polyester, far too few automobile tires, and so forth.

In sum, the account runs as follows: Science has given far more than it has consumed in funds; thus, it has been worthwhile. Even space research, which at present is still very costly, has provided and will provide us, for example, with great advantages for everyday appliances of the highest reliability and outstanding use-value; these advantages are available because of the space instruments which are both miniaturized and tough (constantly withstanding conditions in space). Here, too, I can quote again from L. I. Brezhnev's speech: "It has been figured out that for every ruble spent for the development of science in the system of the Academy of the Ukrainian SSR there is a profit on the order of 5 rubles. That makes sense: spend 1 ruble, get 5 rubles back."

I do not mean to claim that the results in our academy are generally just as favorable as in the Ukrainian Academy; but estimates made by us produced approximately the same figures.

Let me say further: Research is always associated with a justifiable risk. If we do not undertake any risky tasks, then we will be stuck in mediocrity. Since a distinction must be made between recklessness and conscious risk, it is no disaster and disgrace if investigations sometimes have a negative result and the money was apparently spent in vain. Even a definite "no" to a scientific question can be a positive result. Then we know that things cannot be done that way.

In summary it must be said that it is worthwhile to "spend a lot of money" for science in a sensible and responsible way. I once enumerated in a speech to school children how many things did not exist when I was as old as my 14-year old listeners. Each of your older readers can do the same thing and he will immediately see what science has accomplished.

Faster Application in Practice

SZ: It is chiefly industry that has enormous need of the advance achievements of science. The academy does basic research; what ways are there to put partial findings more quickly into practical use?

Professor Klare: In the past few years we have thought about this intensively and found appropriate solutions which we are using or testing. The most favorable is systematic direct cooperation between industry and academy (Academy of Sciences [AdW]) in which the contributions of our research, which are to be put to use, are put down in agreements and ultimately in rosterbooks of responsibilities. But at the same time these rosters of responsibilities also contain the accomplishments of our cooperating partners in industry, i.e., they show what happens with the results from the AdW. This cooperation functions best where corresponding research installations exist in industry. Other productive forms of cooperation are industry-AdW-advanced school-cooperative groups, for example, the Freiberg Cooperative Group for Science, and recently also the so-called academy-industry-complexes. The last-named installations are joint research installations of the AdW and industry, operated as it were "under one roof," from basic research up to the desired end-result; they are already working in the area of pharmaceuticals research and making a start in technical microbiology and in the application of polymers.

We have also found that delays in putting partial results of basic research into practice arise from the fact that the staff employees of the AdW have not become sufficiently familiar with the requirements of industry, that the results from the AdW do not have the necessary technological maturity to be adopted or, which also happens, that the results from the AdW do not offer industry any economic advantages. The chemical research sector of the AdW very recently carried out a very careful and penetrating analysis of the use of the scientific-technical progress worked out in the last 5 years by the AdW and in so doing arrived at extremely revealing results. Using this as a basis, we are at present involved in drawing the necessary conclusions from this analysis, doing so jointly with the Ministry for Chemical Industry, so that advantages are better utilized and acknowledged errors and inadequacies are removed which have resulted in delays or rejection of putting research results into practice. We shall also carry out like investigations in the research sector for physics and nuclear and materials sciences, as well as in the biosciences research area in order, in the sense of your questioning, to draw the necessary conclusions.

Longer-Range Research in Industry?

At present the academy has about 18,000 staff workers and is doing research in all scientific disciplines (including medicine and the social sciences). In order to explain the distribution of potential in the area of research and development I would like in this connection to point simply to the fact that in the chemical industry alone more people are occupied in research and development than in the academy as a whole. The same thing is also true of other ministries.

If one looks around in the world, then one will very quickly determine that even in industry research for so-called advance accomplishments, that are sufficiently related to results and specific to a branch, must be carried out, and I maintain and can also prove that this branch of research was badly neglected in a group of combines and VEBs and unfortunately still is. The overall scientific head start for industry cannot come only from the installations of the AdW and advanced schools, primarily those kinds of technical basic research which make demands for raw materials, water, steam, electrical energy and so forth, demands which exceed the capabilities of an academy-institute, but which are available without further ado in an industrial installation. We observe with great care--and I have already referred to it in my discussion paper at the ninth party congress-that the proportion of those research staff members in industry occupied in advance research (basics, including applied research)--aside from exceptions--has declined in the past few years, or--measured on an international scale--is actually too low. There are statistics which clearly show that. A general turning must take place at this point, that is, industry, too, must carry out research on a long-term basis.

What Are Outstanding Accomplishments?

SZ: In connection with outstanding accomplishments we often hear "short-term, goal-oriented and lasting" discussed. There are voices that see that as a contradiction in itself. How do you define the term outstanding accomplishment?

Professor Klare: I am of the opinion that one has to proceed on the basis of the kind of scientific activity if one wants to define the concept outstanding accomplishment. One-time scientific achievements are, for example, the Theory of Relativity, Heisenberg-Schroedinger's wave mechanics, Planck's action quantum, macromolecular chemistry developed by Staudinger, and so forth. You see, it is a matter of fundamental findings on the basis of theoretical-mathematic considerations and/or experimental work. I do not believe that there are differences of opinion about that: We strive for such "outstanding accomplishments" but one cannot plan them on a "short-term" and "goal-oriented" basis. But we can create prerequisites for that

by having, for example, hand-picked, good, talented and imaginative collectives work on a long-term basis in a scientifically favorable atmosphere. That kind of research, by the way, for the most part does not require expensive means. Naturally in this, too, you need general instructions so that there is no waste of energy: I see that in the scientific recognition which such a collective enjoys internationally. Here, for example, the interest or disinterest, which well-known scholars in the Soviet Union have in such work, is an infallible "barometer" of the state of one's own work.

When the term "outstanding accomplishment" is used, then as a rule, such one-time accomplishments are not meant, but rather--just as important and just as necessary--scientific results which quickly or in the foreseeable future become socially useful. Such an outstanding accomplishment is determined by several criteria.

First, by its degree of newness, demonstrated on the basis of the international level of science and technology. This criterion must be fulfilled, otherwise it is not an outstanding accomplishment; this evaluation must withstand the most rigorous testing. Thus, copying is not an outstanding accomplishment if the parameters of the model are not exceeded. This does not mean that an "after-discovery" is to be rejected in every case, for that depends on the economic facts in each instance. But if one acquires a process license and improves this process in such a way that the licensor can then once again be sold a license, that is definitely an outstanding achievement.

Second, by the kind of result (device, process, patent, book, and so forth). The way in which the outstanding accomplishment exists is immaterial to begin with; even a book of social scientific content, which, for example, triggers scientific or political discussions for the benefit of socialism, is undoubtedly an outstanding accomplishment.

And finally, and not immaterial: The value of outstanding accomplishment naturally goes up if it becomes economically or socially effective as quickly as possible. Nonetheless, an outstanding scientific achievement (as long as it does not have to do with devices, instruments, designs or processes) cannot first be judged only by its practical effectiveness since, as is known, it can take a rather long time before being used. I am thinking here, for example, of the investigations on the use of nuclear fusion for producing energy. From my statements you see that this concept has many layers. Systematic and goal-oriented task setting for outstanding scientific achievement of the kind just described is naturally possible and even necessary; in this regard we should not forget that tasks can be planned, but not discoveries. These come about in the course of solving a well-thought-out task, of course its point in time is uncertain. Things

are different with devices and processes, where the desired parameters can be specified. In any case, because of the nature of the matter, I, of course, doubt that "in decisive areas lasting scientific-technical outstanding achievements can be guaranteed." That in no way opposes the efforts we must make in order to keep the level of our research results and products at such a height that we are always one step further or better than others in areas that are decisive for us. That seems to me to be a necessary and desirable goal; it also does not require complicated definitions, since something like that can be clearly verified (especially with products of all kinds).

Technology--a Stepchild?

SZ: Practice seeks a large number of answers to questions provoked by the most modern technologies, such as plasma melting. May we also ask the academy why we have so many difficulties with technology?

Professor Klare: Without a doubt this question is justified. I already went into this in my answer to the second question; I will not repeat that here. With the help of our research results it has turned out that research institutes successfully put their results into material production as a rule only if they have a suitable technical-technological base at their disposal, with whose help they can produce sample products and in connection with that they can work out and make new processes ready for production. Consequently, there is provision in the five-year plan of the academy to set up and/or rebuild 11 technical schools. Those are, as stated, the conclusions which the AdW has drawn from the fact that "we have so many difficulties with technology."

Since I have concerned myself for approximately 20 years of my life intensively with technological problems I know exactly what I am saying when I stress that industry, the advanced school system and the academy absolutely cannot attach enough importance to technology and the research necessary for it (for example, process technology); unfortunately that is still not recognized everywhere--as statistics again show--and I have been told that process technologists are often felt to be more like the fifth wheel on a car. This position should be as quickly as possible revised wherever it exists. The academy has, in any case, drawn its conclusions from bad experiences, as I said at the beginning.

Neglect in Microelectronics?

SZ: There is the view in Dresden that the Rossendorf Central Institute for Nuclear Research [ZfK] and other academic installations can provide even more effective research accomplishments in an area so ripe for the future, such as microelectronics. How does the president judge that?

Professor Klare: Without wanting to dispute that the Rossendorf ZfK can also provide effective research accomplishments for microelectronics, it is necessary to point out that the ZfK must first research what its name says. In this, it has to do with reactor research, i.e. contributions to preparation, starting up and operating nuclear power plants, in particular for increasing effectiveness, availability, guaranty and reliability of the installations, including control of the nuclear fuel cycle, control and guidance of nuclear power plants and development of devices and equipment for nuclear power plants. In the framework of its limited capabilities the ZfK is furthermore also concentrating its work on development contributions for fast breeder reactors. So much very briefly concerning the chief tasks of the ZfK; in this connection I have not mentioned nuclear physics at all which we are also pursuing there.

Of course, the academy has asked itself what neglect it has committed so that it could happen that they are behind in the area of microelectronics. With the help of these critical considerations and analyses--to be brief--a list of accomplishments by the academy for the Ministry for Electrical Engineering and Electronics has been worked out which contains all contributions the AdW had dealt with in the area of microelectronics from 1977 and will continue to work on until 1980. These research activities are covered by all institutes in the research area of physics, nuclear and materials sciences and, for example, also institutes in the research areas of chemistry, mathematics and cybernetics. Moreover, after a detailed discussion on 25 March 1977 a new agreement on cooperation was signed by the minister for electrical engineering and electronics and myself. Naturally, the research achievements of the AdW for microelectronics likewise played an important role in this.

Attractive for Integration?

SZ: Effective research is unthinkable without an international division of labor. The presidents of the friendly academies of the socialist countries met recently in Moscow. Are we already fully exhausting the advantages of integration in this area of science?

Professor Klare: I probably do not have to say anything more about the meeting of the presidents of the friendly academies in Moscow from 14-18 February since NEUES DEUTSCHLAND reported on it in an extensive communique. I also assume that the real issue is the last sentence of your question. It would, of course, be imprudent of me if I answered "yes," the person asking the question probably even expected a "no."

The academy has concluded cooperative agreements with academies of socialist countries, especially with the AdW of the USSR, for about 75 percent of the research topics it has dealt with. Nonetheless, we are not necessarily

proud of this number since the joint research work, which is effectively carried out with a division of labor, is in no way in line with this percentage. Also, it is precisely for this reason that we are not yet exhausting the advantage of integration. In the second place we are not yet making extensive enough use of the exchange possibilities of scientific cadres that are available to us. I would wish that the number of young scientists who, for example, have been working for 2 or 3 years in an institute of the Soviet Academy or another friendly academy were higher than it now is; naturally the reverse is also true, that and other foreign colleagues who pursue research together with us in our institutes.

In conclusion I would like to repeat once more what I briefly suggested earlier. We can exhaust the advantages of integration in the area of science only when our objectives and research results are scientifically interesting and productive for our partners. At the same time, to recognize this means to remember the sentence I gave to you at the end of my answer to your third question, namely, to keep the level of our research at such a height that we know, in areas of research decisive for us, at least as much, but better yet a bit more than our partners. That is not arrogance, but rather an expression of healthy scientific competition, which we must withstand if we want to exhaust all the possibilities of international socialist integration.

How Does the Research Urge Grow?

SZ: Certainly the will to accomplish is variously stamped in every man, thus also in the scientist. No one can command someone to invent, to discover. But how can the desire in the researcher, in your view, best be stimulated?

Professor Klare: Naturally no one can be ordered to invent or discover something; but a scientist must have the irresistible desire to do so. If I cannot presuppose the will to achieve or the urge in the researcher, but must first stimulate him, then he (or she) has missed his calling. I already stated elsewhere that scientific work cannot be completed according to the pattern of a work contract or a 42-hour week. To be a researcher is not a profession, but rather a calling, in the best sense of the word. Anyone who is not prepared to surrender completely to his scientific work, anyone who watches the clock to see if it is not soon closing time when he is experimenting or thinking, and anyone who expects a stimulant, so that something new will occur to him, will not get very far in science. Naturally, I do not mean to say that scientists are to be paid the worst of all comparable occupational groups, naturally I do not reject offering, as an incentive, an appropriately high bonus for the speedy solution of a difficult task; I object to that only on principle, that there must first be talk of a stimulant before a marked will to achieve becomes apparent.

Thorough knowledge, imagination, industry and patience, alongside impatience and curiosity, are some attributes of the scientist which he should bring along or which must be taught to him in the collective to the extent that a young man does not yet control the one or other. In addition, there must be enthusiasm for the task which he must solve, enthusiasm in good and in difficult situations; for research often means more disappointment than success, the number of experiments that turn out negatively is as a rule larger than those that are positive, and now and then it takes years before the final success appears. For this there are sufficient examples in the history of science. Constancy to the point of obstinance and again and again courage to continue after thorough consideration are included in this.

There is something to Edison's famous statement that the successful inventor is 99 percent perspiration and 1 percent inspiration. More than ever scientists must stand on a foundation that is secure, uniform, and philosophically moral and which conveys to the collectives and individual personalities the attitude which identifies them--in every life situation--as educated socialists. This includes sympathetic understanding, collegiality and understanding for the cares of others and the awareness that a great deal depends on the exemplary effect.

Thus, if one speaks of stimulating, then--in my opinion--scientists should not have any pronounced material cares, their working and living conditions should be such that where they work there is a good atmosphere, conducive to science, they should not be burdened with superfluous adminstrative work; for their time is costly and one should have confidence in them, in difficult phases of their work, especially whenever they were ready to assume the risk for a job which leads into virgin scientific-technical territory. Finally, one should give them a certain latitude within the framework of planning in which they can pursue new ideas which perhaps were not planned on from the start, or stated differently: research must be planned, but let us be careful not to want to regulate everything.

What I am saying here is not at all new. Accordingly, you will find that in the decisive speeches that Prof Kurt Hager has given before scientists. You will also find that, for example, in the lectures and articles of the president of the research council, Prof Max Steenbeck; and I have also spoken and written about it earlier. By the way, I do not say that to protect myself, but rather to state that I am uttering all wisdoms in this matter: One cannot buy love and one also cannot conjure up new ideas with the best stimuli if the one you want to stimulate does not completely identify with his task. In this matter ethical principles are at work--as with any job which one must do with all his heart--, one does not get very far with material solutions alone.

SZ: Please accept our hearty thanks for the interview. Also heartfelt thanks to the party secretaries, scientists and managers of our bezirk who helped us formulate questions for Professor Klare.

12124

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ROSTER OF NEW DOCTORS AND CANDIDATES OF SCIENCES PUBLISHED

Budapest MAGYAR TUDOMANY in Hungarian No 7-8 Jul-Aug 77 pp 624-626

[News from the Committee of Scientific Qualification. New Doctors and Candidates of Sciences, April 1977]

[Text] I.

The Committee of Scientific Qualification declared

Imre Csiszar, doctor of mathematical sciences, on the basis of his dissertation entitled "Information Value Coefficients and Their Applications"; the opponents were: Bela Gyires, Sandor Csibi, and Zoltan Daroczy, doctors of mathematical sciences;

Jozsef Horvath, doctor of agricultural sciences, on the basis of his dissertation entitled "Virus Host Plants and Virus Differentiation"; the opponents were: Janos Szirmai, doctor of agricultural sciences, Ferenc Solymossy, doctor of biological sciences, and Istvan Milinko, candidate of agricultural sciences; and

Jozsef Toth, doctor of agricultural sciences, on the basis of his dissertation entitled "Optimization of the Use and Distribution of the Production Factors in Agriculture"; the opponents were: Ferenc Vagi and Ferenc Fekete, doctors of economic sciences, and Bela Kreko, candidate of mathematical sciences.

II.

The Committee of Scientific Qualification declared

Ahmed Abdulkarim Aioukahoh, candidate of agricultural sciences, on the basis of his dissertation entitled "Investigation of the Factors Determining the Quality of Red Wines";

Gabor Balint, candidate of medical sciences, on the basis of his dissertation entitled "Data on Some Aspects of the Toxicology of Experimental Ricine Intoxication";

Janos Barta, candidate of historical sciences, on the basis of his dissertation entitled "The Agricultural Policy of Enlightened Absolutism During the Hapsburg and Hohenzollern Monarchies";

Laszlo Czako, candidate of medical sciences, on the basis of his dissertation entitled "Therapy of Diabetes Insipidus";

Nghiem Xuan Dam, candidate of agricultural sciences, on the basis of his dissertation entitled "Analysis of the Modern Methods of Harvesting and Drying Grain Maize, With Special Emphasis on the Manufacture of Corn Meal";

Judit Daroczy, candidate of medical sciences, on the basis of her dissertation entitled "Electron-Microscopic Ultrastructural Studies in Dermatological Research and Clinical Diagnostics";

Erno Gyorgy Duda, candidate of biological sciences, on the basis of his dissertation entitled "Synthesis of Sindbis Proteins in BHK Cells";

Ali Abdou Mohamed Eg-Ebedy, candidate of veterinary medical sciences, on the basis of his dissertation entitled "Mycoplasm Infestation of Turkeys, Geese, and Ducks";

Andras Egyed, candidate of biological sciences, on the basis of his dissertation entitled "Mutual Mechanism of the Transferrin-Reticulocyte Interaction";

Maria Farkas, candidate of medical sciences, on the basis of her dissertation entitled "Age and Heat Regulation in Rats and Guinea Pigs";

Zsofia Feher, candidate of chemical sciences, on the basis of her dissertation entitled "Voltammetric Measurements in Flowing Electrolytes";

Tibor Ferenczi, candidate of agricultural sciences, on the basis of his dissertation entitled "Branch Control, Producer Attitude in Cattle Raising";

Istvan Foldvari, candidate of chemical sciences, on the basis of his dissertation entitled "New Results Obtained Through the Vacuum-Ultraviolet Spectroscopic Examination of Substances With a Broad Forbidden Band";

Lajos Gergely, candidate of medical sciences, on the basis of his dissertation entitled "Relationship Between the Epstein-Barr Virus and Receptive Lymphoid";

Gyorgy Gondos, candidate of chemical sciences, on the basis of his dissertation entitled "Synthesis and Stereochemical Study of Alicyclic 1,3-Bifunctional Compounds";

Gabor Horvath, candidate of biological sciences, on the basis of his dissertation entitled "Formation of Granum-Like and Non-Granum-Like Chloroplasts on Greening Maize Leaves";

Aron Jambor, candidate of geological sciences, on the basis of his dissertation entitled "Geological Conditions of the Pannonian Formations of the Central Mountains of Transdanubia";

Adrienne Karczag, candidate of biological sciences, on the basis of her dissertation entitled "Investigation of Natural mRNA Ultraviolet Damages on MS2 Phages";

Robert Kersner, candidate of mathematical sciences, on the basis of his dissertation entitled "Some Properties of the Generalized Solutions of Quasi-Linear Degenerating Parabolic Equations";

Kornelia Lang (Mrs Lakos), candidate of chemical sciences, on the basis of her dissertation entitled "Investigation of Intramolecular Catalysis on 5,6,7, and 8-membered Alicyclic Compounds Through Their N-O Acyl Migration, Ester Hydrolysis, and Ester Acetolysis Reactions";

Endre Lehoczky, candidate of biological sciences, on the basis of his dissertation entitled "Spectral Forms of the Photosynthetic Pigments and the Mechanism of Electron-Generation Energy Transfer in Pigment-Detergent Micellar Models";

Emil Maleczky, candidate of chemical sciences, on the basis of his dissertation entitled "Formation of Conversion Layer on Aluminum";

Pal Maliga, candidate of biological sciences, on the basis of his dissertation entitled "Preparation of the Tobacco Mutants With Resistance to Bromodeoxyuridine and Streptomycin in Haploid Tissue Cultures, and Their Basic Properties";

Pal Meszaros, candidate of chemical sciences, on the basis of his dissertation entitled "Flow and Material-Transfer Characteristics of Trays With Annular Valve, Perforation, and Slotting, Without Overflow";

Tamas Mohr, candidate of pharmacy sciences, on the basis of his dissertation entitled "Utilization of Organizational Theory in Institutional Pharmacies";

Laszlo Nagy, candidate of historical sciences, on the basis of his dissertation entitled "Changes in the Strategies and Tactics of the United States During the Early 1960's, During the Presidency of J. F. Kennedy (1961-1963)";

Gyorgy Pogacsas, candidate of agricultural sciences, on the basis of his dissertation entitled "Theoretical Fundamentals and Practical Applications of Industrial-Scale Specialized Pea Growing" (awarded posthumously);

Jozsef Ruszoly, candidate of political and legal sciences, on the basis of his dissertation entitled "History of Arbitration in Hungary";

Peter Scharle, candidate of technical sciences, on the basis of his dissertation entitled "Numerical Solution of Linear and Non-Linear Architectural Continuum Tasks by the Generalization of the Error Theory";

Zoltan Schay, candidate of chemical sciences, on the basis of his dissertation entitled "Adsorption of Carbon Monoxide on Platinum";

Laszlo Szabo, candidate of chemical sciences, on the basis of his dissertation entitled "Investigations on the Applications of Solid-Phase Synthesis in Alkaloid Chemistry";

Janos Szolcsanyi, candidate of medical sciences, on the basis of his dissertation entitled "Mechanism of Sensory and Neuroregulatory Functions on the Basis of the Effects of Sapcaicine and Its Structural Analog";

Attila Torok, candidate of biological sciences, on the basis of his dissertation entitled "Mathematical Analysis of the Stimulation Processes of the Receptor Neuron";

Doan Xuan Thin, candidate of agricultural sciences, on the basis of his dissertation entitled "Possibilities of Reducing the Comminuting Energy";

Eszter Lang (Mrs Andras Varga), candidate of medical sciences, on the basis of her dissertation entitled "Experimental Analysis of the Physiological and Morphological Aspects of the Thalamo-Cortical Relationships During the Transfer of the Afferent Somatic Signals";

Ferenc Varnai, candidate of medical sciences, on the basis of his dissertation entitled "Domestic Aspects of the Clinical Care of Tropical Parasitic Diseases";

Endre Vizvari, candidate of transportation sciences, on the basis of his dissertation entitled "Some Infrastructural Ramifications of the Maintenance System of Private Passenger Automobiles"; and

Odon Zoltan, candidate of political and legal sciences, on the basis of his dissertation entitled "Responsibility for Damages Caused in Wildlife in the Course of Hunting."

2542
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HUNGARY

CEMA SPECIALIZATION IN NUCLEAR POWER PLANT PRODUCTION

Budapest NEPSZABADSAG in Hungarian 20 Aug 77 p 7

[Interview with Dr Janos Heiczman, deputy minister of metallurgy and the machine industry, by Jozsef K. Nyiro]

[Text] Nuclear power plants have come to the fore throughout the world in recent years. The CEMA countries developed a special goal program for specialization of nuclear power plant production. What does this special program contain and how will the use of nuclear energy develop over the long range here and in the other CEMA countries? We talked about these questions in the Ministry of Metallurgy and the Machine Industry with Deputy Minister Dr Janos Heiczman.

More Swiftly Than the World Average

[Answer] Nuclear power plants are being built in the CEMA countries at a pace exceeding the world average. Last year the total capacity of nuclear power plants in the socialist countries was 7,500 megawatts. According to data of the joint prognosis of the member countries going up to 1990 the total capacity of the nuclear power plants of the member states will be about 30,000 megawatts in 1980, four times that of 1976.

According to the plans the nuclear power plants to be completed will cover almost half of the electric power needs in several CEMA countries, including our homeland, by 1990. Of course, an indispensable condition for the creation of nuclear power plants is a swift development of the manufacture of nuclear power equipment. Nuclear power machine manufacture still has a narrow cross-section in the machine industry of the CEMA countries. This tension can be resolved only within the framework of socialist cooperation. In the interest of this the CEMA countries and Yugoslavia created the Interatomenergo International Management Association which has the task of organizing manufacturing cooperation and delivery of nuclear power plant equipment and giving technical aid to the creation of nuclear power plants.

As a first step, in accordance with resolutions passed at the 29th and 30th sessions of CEMA, experts developed a program for the years 1981-1990 for

maximal development of the nuclear power machine manufacture of the CEMA member countries including cooperation and manufacturing specialization questions appearing in this area. The program contains the most important tasks to be carried out in the area of the development of the nuclear power machine manufacture of the CEMA member countries as well as manufacturing specialization and cooperation recommendations pertaining to nuclear power equipment.

[Question] At the most recent Warsaw session of CEMA the member countries drew up an account concerning the situation in working out the special program. What was the essence of this account?

[Answer] The representatives of the member countries discussed and adopted at Warsaw the draft for this program. Realization of this program will be of great significance in a further development and deepening of the economic integration of the CEMA member countries. Fulfillment of the program will make possible a swift development of nuclear energy, a solution of a part of the combustible fuel power problems and an increase in the manufacture of nuclear power plant equipment. In order to realize these goals the coordination of manufacturing and delivery plans for nuclear power equipment will be absolutely necessary, among other things; bilateral and multilateral specialization and cooperation agreements must be signed; there must be cooperation in the creation of some special manufacturing capacities; and there must be agreement in questions of economic conditions.

We must carry out the tasks connected with development of the program on a stressed and accelerated basis within the framework of the CEMA machine industry special program. According to the program the multilateral specialization and mutual delivery contracts pertaining to the years 1981-1990 must be signed in the first half of 1978. At the same time we must work out by the end of next year subunit specialization and manufacturing cooperation agreements for special nuclear power plant equipment as well as agreements pertaining to manufacture of forged pieces, prefabricated items and complete parts.

15-20 Billion Forints in 10 Years

[Question] How will our homeland fit into this program of the CEMA countries?

[Answer] The interested countries will develop the manufacturing specialization schedule in several phases. The first step will be agreement on specialization ideas for the prime equipment which will be followed quickly by specialization for the general power plant equipment, instruments, automatic elements and electric equipment needed for nuclear power plants. In accordance with this the manufacturing specialization register for prime equipment for the period 1981-1990 will contain, among other things, four product groups in the manufacture of which our homeland also will specialize--special water purification equipment, reactor servicing machines, case reloading machines, and other special repair and maintenance machines and transportation technology equipment.

We will harmonize in advance the delivery volumes for this equipment. According to these plans we will deliver to friendly countries during 10 years approximately 50,000 tons of nuclear power plant prime equipment at a value, according to technical estimates, of 15-20 billion forints.

[Question] The manufacture of nuclear power plant equipment is a complex task requiring a high technical level. Are there domestic experiences in this area?

[Answer] A foundation for the discussions thus far was provided by the fact that on the basis of an inter-government agreement the manufacture of special nuclear power plant equipment and repair and maintenance machines has begun already in Hungary for the years 1976-1980. The delivery of some equipment or machines has already started.

[Question] What measures do you consider necessary to realize Hungarian participation in the program?

[Answer] Preparation for manufacture of nuclear power prime equipment is a serious economic interest for us. Fulfillment of our long range nuclear power plant construction program depends on realization of this too. In addition, getting experience in manufacture of nuclear technology could have a favorable effect, an effect which cannot yet be fully measured, on the development of other economic branches too.

When the program was being worked out we strove to undertake specialized manufacture of that nuclear power plant equipment which best corresponds to the resources of domestic industry and to our technical preparedness. It is obvious, however, that preparation for this task can take place only by carrying out developments and in some cases by creating new production sites. On the basis of preliminary calculations the developments will cost several billion forints. Considering the magnitude and importance of the task I think it would be proper to realize these developments within the framework of a central developmental program. Deciding this question, however, will require further study and a government level decision.

Decision By The End of the Year

Realization of the program, however, will require not only the development of fixed assets; it also involves the realization of very important human tasks. Manufacture of nuclear technology tools requires a high scientific-technological level involving highly qualified skilled labor. So we must think about teaching new technologies and organizing various special study courses, among other things.

The State Planning Committee must prepare by the end of the year a proposal concerning the domestic measures needed to carry out the tasks deriving from the program. On the basis of this it will define over the long run the direction and pace of domestic development of nuclear power machine manufacture.

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PROBLEMS OF GROWING CRYSTALS AND COMPOUNDING BASIC MATERIALS

Budapest MAGYAR TUDOMANY in Hungarian No 7-8 Jul-Aug 77 pp 621-624

[Article by Tivadar Siklos and Rudolf Voszka]

[Text] The Solid-State Physics Complex Committee of the Academy and the Solid-State Research Coordinating Council Sponsored a one-day conference on 8 February 1977 at the Crystal-Physics Research Laboratory of the MTA [Hungarian Academy of Sciences] on the theme "Domestic Problems in Crystal Growing, Solid-State Research, and Preparation of Industrial Base Materials."

The opening lecture was delivered by Academician Lenard Pal, chairman of the Complex Committee and the Coordinating Council. The lecturer stressed the importance of the basic materials and their manufacturing technologies for industrial development. The purpose of the conference is to review the situation in Hungary and to establish the most important taskson the basis of the debate of the review.

The conference started with four debate-starting reports. Below we briefly discuss them.

Academician Mihaly Stefan stressed the importance of the high quality of metallic structural materials for product development. He illustrated with figures the expected developments in the non-ferrous metallurgical industry and pointed out the major changes which result in increased quality demands.

He discussed some major developments from the plans for non-ferrous metallurgy. He stated that considerable advancement resulted from the acquisition of the licence of the so-called overcrystallization method in the

production of copper. The principle of the method is to increase the diameter of a copper wire passed through a bath of liquid copper. This is accomplished by overcrystallization. Part of the wire is passed back from the takeup reel into the melt, and the rest is processed. The advantage of the method is that a single integrated technological process is used to make high-quality basic material for the cable industry and other users. Guided crystallization is achieved in the manufacture of non-ferrous metal strip by the horizontal continuous strip-casting method. This facilitates the subsequent processing of the materials and yields higher-quality products. Amounts as high as 1.5 tons are crystallized in this manner in vacuum-induction melting furnaces, using the vacuum-arc method. It appears that this method will replace the electron-beam technique.

The speaker stressed that the character of metallurgical operations is undergoing a change, and that the main operation gradually becomes the instrumental control of the processes. As an example, he discussed the mass-spectroscopic control of metallurgical processes from his own experience.

Csepel Works keeps step with international developments and uses modern technologies. However, the latest achievements of technological research indicate that many additional methods may be developed (for example microalloying, use of very small amounts of alloying ingredients, and so forth) for further improvements in material quality. Research in Hungary must devote some effort to these.

Senior Department Head Odon Lendvai lectured about semiconductors. He stated that world production of semiconductor single crystals reached the annual volume of 1,000 tons in 1976. This fact affects many industry branches through the electronic industry branch. Scientific research also grew at a fast rate in recent decades, parallel to the spectacular growth of industrial production.

In Hungary, cooperation between research and industry created the base for germanium-based semiconductor manufacture before the late 1950's, while germanium dominated semiconductor manufacture. These facilities are still operational today. Insofar as silicon is concerned, the situation is not as favorable; after some initial successes, the manufacture of single crystals bogged down. Today practically no single silicon crystals are being made in Hungary. The demands tend to shift worldwide toward relatively large-diameter (8-10 cm) crystals with few dislocations (perfect structure). The manufacture of such crystals is expensive, requiring largely automated growing facilities with high productivity.

In addition to the conventional semiconductor elements from Column IV of the periodic table of the elements (Ge, Si), additional elements and their compounds are also being used now for semiconductors. Among these new elements we find some from Columns III to V, such as gallium arsenide. They are even more difficult to manufacture, since it is necessary to have computer-guided methods which simultaneously adjust many parameters. No such equipment exists in Hungary today.

However, so-called epitaxial methods are being used at a high level for the production of thin semiconductor layers. The principle of this method is that the single crystal layers are grown on substrate single crystals from the liquid or vapor phase.

Research in the field of semiconductor basic materials necessitates the availability of appropriate instruments for orientation, fabrication, measurement of dislocation density, analysis, and determination of semiconductor and optical characteristics.

Finally, the speaker outlined the tasks ahead. He pointed out that the basic materials for the semiconductor device manufacturing program must be obtained from external sources since it does not pay to procure single-crystal drawing equipment which could produce more than we need. Such equipment is very costly. Consideration should be given, however, to the fact that we might be well advised to market our gallium resources, which represent approximately 20 percent of the world output, in the form of high-purity polycrystalline basic material rather than raw material.

Candidate Geza Konczos spoke about magnetic materials. He reminded the audience of the close relationships that exist between magnetic properties and crystal structure. As a result of this relationship, research in one aspect affects the development of the other.

The speaker outlined the path traveled by KFKI [Central Research Institute of Physics] in the field of single-crystal technology. During the 1960's, the production was concentrated on metal crystals, which were manufactured by simple techniques in relatively modest quality. This was a good time to acquire knowledge about high-temperature technologies and to forge a good team of experts. From the 1960's onward, they traveled the road which was also traveled by research establishments abroad, namely the road of bubble-memory research. They started by making orthoferrites with the flux method. The principle of this method is that the material to be crystallized is dissolved in an appropriate salt melt: the nuclei grow during slow cooling.

Sheets having a thickness of 50 to 100 microns are to be cut from the orthoferrite, and the bubble domains (50 to 100 micron diameter magnetically oriented areas which differ optically from the surrounding areas) are to be prepared or moved — with an external inhomogeneous magnetic field — in these domains. This is followed by the preparation of epitaxially grown garnet layers on the single-crystal substrate. In these layers, the domains are already between 4 and 9 microns thick. In order to accomplish this, the growing method of the substrate single crystal, the growing of the gallium gadolinum garnet (GGG) and the epitaxial layer growing had to be developed. For this purpose, high-temperature Czochralsky crystal-drawing equipment is installed with a high degree of automation. High-quality GGG crystals are grown in this apparatus. The principle of the Czochralsky method is to crystallize the melt on relatively fast-rotated, cooled nucleus crystal while the nucleus is slowly raised. There are also automated layer-growing methods for epitaxial layers. They are now in the process of being fully automated.

Finally, the speaker discussed the single crystal growing experiments being carried out at the Research Institute for Telecommunications. In that institution, the flux method is used to prepare ferrimagnetic garnet single crystals for microwave applications.

Candidate Rudolf Voszka discussed the problems of the optical materials.

He stressed the materials for light modification, the geometric optical elements (windows, lenses, prisms, and so forth). Additional requirements are imposed on these items in high-power laser studies: they must withstand high energy densities without damage.

Non-linear optical elements play an important role in laser technology. They include the frequency multipliers which, for example, convert red light into blue light. They also include the deflectors, which deflect the direction of light travel. They also include the modulators, which permit information to be superimposed on the light. They also include the light switches, which permit the generation of very brief light pulses. They also include the optical memories, which are suitable for intermediate or final storage of information. They also include tunable optical filters, which select a narrow range from the white light. All these elements are made of single crystals, for example of KDP (potassium dihydrogen phosphate), tellurium dioxide, lithium niobate, and so forth. Present domestic research programs require optical materials of these types.

The domestic production of optical single crystals is based on three research facilities. The KFKI has the experience for high-temperature crystal drawing; thus, in principle the base may be expanded to the manufacture of optical single crystals. The Crystal Physics Laboratory has experience with several methods for the melt-growing at not too high temperatures. The Department of Physics of the Technical University has experience with various methods of growing from solution.

These research institutions deal not only in growing technology but also in related aspects of chemistry, orientation, and fabrication, as well as quality control of crystals. Developments are aimed for in these areas. The speaker listed those difficulties which stand in the way of fast development. They include the difficulties encountered in acquiring crystal-growing and crystal-evaluating equipment, difficulties in training suitable specialists, and problems in the scientific development of those working in the field.

He also asked the often-asked question once again: should there be or should not there be an experimental plant? His position in this matter was the following: under the present circumstances, the financial resources should be concentrated on the above-mentioned three research establishments, where a team for training specialists should also be assembled. These facilities may, if needed, perform limited production, and may prepare for larger-scale production so that the developed large-scale method would be fit to transfer to industry.

The papers were followed by a thorough, high-level debate. The participants of the conference were shown crystals being currently produced in the country.

In the second part of the scientific conference, reports were presented about some achievements of the Crystal Physics Laboratory of the MTA by members of the Laboratory's staff. Then, the participants visited the laboratory and became familiar with the research work being performed there.

The major conclusions of the conference may be summed up as follows:

1.The participants agreed that the situation is favorable in the field of research on metals. There is a good relationship between research, development, production, and marketing; there is good relationship between the research establishments and the industrial enterprises (KFKI, MFI [Institute of Technical Physics], university departments, Csepel Ferrous and Non-Ferrous Metallurgical Works, United Incandescent Lamp Factory). The goalsof research are related to the long-range economic goals; they facilitate their conclusion.

On the basis of the analysis of the economic interests, the industrial managers may affect the goals of scientific research work; at the same time they pay great attention to any new achievements that emerge from the research sphere so as to make timely and good use of them for industrial manufacture. A good example of this is the study of glass metals. This matter is still in the stage of research everywhere in the world; however, it seems that there is validity in the forecast that practical applications will be evident in 1980 or so. Recognizing this fact, the KFKI, MFI [Institute of Technical Development], and Csepel Ferrous and Non-Ferrous Metallurgical Works laid out a joint plan for research first and for the preparation for industrial manufacture later.

2. Insofar as research in the field of magnetic materials is concerned, the emphasis everywhere in the world during the last ten years — and also in Hungary — was on studies of the magnetic materials needed by computer technology and automation. The wide spread of small computers, and primarily the significant growth of microelectronics made the development of background memories adapted to highly integrated solid-state devices (such as microprocessors) an urgent task. It should be noted that magnetic bubble memories — which contain no moving mechanical parts — are eminently suitable for this purpose. The achievements of the KFKI (development of the manufacturing technology of single crystals carrying gadolinum garnet as a substrate, the solution of the problem of how to grow thin-layer crystals epitaxially, and so forth) represent a good base for a future cooperation with a production enterprise for subsequent manufacture. This is the Hungarian Optical Works. There should also be a meaningful international cooperation with the appropriate Soviet institutions in the same field (INEUM [expansion unknown]). At the present time, practically all prerequisites are met for research and development: the authorities in the KGM [Ministry of Metallurgy and Machine Manufacture] have the proposal of the KFKI and MOM [Hungarian Optical Works] outlining the activities required to realize experimental manufacture. It appears that there is validity in the forecast that by around 1980 — when the needs for bubble memories will significantly increase as higher-generation computers will be developed and made — the domestic industry will have the needed technical and technological facilities.

3. The situation is quite complex insofar as semiconductors are concerned. In this field, Hungary is quite backward compared to technically leading countries in many respects. It is a well-known fact that the Hungarian communications-engineering, instrument-manufacturing, and computer-technology enterprises procure the most advanced solid-state devices from foreign imports.

Over the long range, we can look forward to the profitable foreign sale of the products of this industry branch only if we manage to come to the forefront in the manufacture of at least some selected instances of the parts that are required.

According to statistical data, there has been increased interest since the mid-1970's in circuits with medium and high degree of integration. The demands are many and varied — in some instances for no good reason. Thus, in order to meet all demands, there will have to be many and different technological methods. It would not be sensible to develop each and every such method to meet the many non-coordinated demands.

In order to end the backwardness of our solid-state industry we attempted to realize some advanced technologies by establishing recently a research and development association for studying modern techniques. It is hoped that this will enable the production of highly integrated device-oriented circuits (such as microprocessors) domestically in the near future. A definition of the development goal in this manner is justified not only by the fact that it would be sensible to omit some intermediate technologies (which would be obsolete on the worldwide level the moment they are started), but also by the fact that we may expect (on the basis of an analysis of the development trends) a slow-down in the development rate of highly integrated solid-state devices, so that in 5-6 years we would still be modern and competitive with our technology. In this connection, we must also consider the fact that device-oriented circuits will remain of cardinal importance as we approach the 1980's, both in the computer industry and the instrument industry, as well as in communications and automation.

Both our research institutions and our industrial establishments must make many initiatives in the field of solid-state research in order to ensure that the unity of research-development-production-marketing develops and grows in this highly important area also.

4. Many outstanding achievements can be reported in the field of research on optical materials. Development was varied and in many fields; however, everything is at a standstill in the stage of laboratory production since our optical industry cannot see clearly how and in which direction to proceed and in which manner it should change over to modern technologies. The situation is further complicated by the fact that the same thing exists over the entire CEMA. The production of these materials still represents an unanswered question. Until the industry needs are clarified, it makes no sense to set up experimental production facilities.

5. The matter of the quality and purity of the chemicals used for these four basic material types is a serious problem. In most instances, but especially for the manufacture of device-oriented solid-state devices, we need exceptionally pure materials and chemicals. We must give this matter serious attention. We must examine whether our chemical industry is capable of producing these materials — or at least some of these materials — in the needed quanity and purity. If not, are we prepared for the evaluation of such materials from import? We hereby propose that the Department of Chemical sciences study this matter thoroughly.

6. We must soon deal with the matter of handling certain special basic materials (such as Ga and V) of which Hungary has large reserves but which are not presently processed in Hungary, so that they must be marketed as raw materials rather than as basic materials, which is less profitable.

7. Problems of university education and the training of experts are serious and pressing problems; they emerged at this conference also. For this reason, the Complex Committee has decided to supplement its original plans and debate during the second half of 1977 the status of solid-state technology education in the universities.

8. Praise is due to the Crystal Physics Group operating within Eotvos Lorant Physical Society. This group has already brought together the experts working in the field of crystal growing in club meetings, professional discussions, and the First Hungarian Crystal Growing Conference, held in 1976 under the Group's sponsorship. The Group will continue to sponsor meetings of the experts in the field, researchers and industrial employees alike, so as to contribute to the accomplishment of the goals which are common to all.

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CSO: 2502

BRIEFS

PROMISING NEW DRUGS--During the Fifth Five-Year Plan research on biologically active compounds will be financed by six chief authorities. Participation will include 89 research sites and 2,000 workers. A total of 2.3 billion forints will be spent on this work during the plan period. Several new drugs have been or are about to be put on the market since this research received priority status in 1972. These include such products as "Grandaxin," a preparation which promotes the equilibrium of the nervous system. It acts as tranquilizer or stimulant depending on the individual taking it. "Lycurin" affects the immune system and is prescribed for cancer. It may be effective in the case of organ transplants as well. "Formil-leurozin," now being tested, may prove effective in combating tumors. Besides the foregoing, there are numerous preparations which look promising for veterinary medicine and agriculture. Among these is "Hubromul" which improves water regulation of the soil and increases yields. The plan determines what is to be done up to 1990. It is expected that 2-3 potent original products will be put on the market in 1985 and 3-5 in 1990. They will be destined for use in medicine, plant breeding and veterinary medicine. The pharmaceutical industry will emphasize more products which act on the central nervous system, the cardiovascular system, preparations to combat cancer and viruses, and geriatric preparations. [Budapest ESTI HIRLAP in Hungarian 15 Aug 77 p 4]

HIGH-YIELD WHEAT TESTS--A promising new variety of wheat, the GK Szeged, developed by the Grain Breeding Research Institute [Gabona Termeszto Kutato Intezet] received outstanding ratings in field tests. Minimum yields per hectare were 78 quintals, while maximum yields came to 93 quintals per hectare. Among the desirable attributes of the bread grain is its eminent suitability for machine harvesting. [Budapest MAGYAR NEMZET in Hungarian 25 Aug 77 p 6]

FINDINGS IN SUPERCONDUCTIVITY--Recently the JOURNAL OF NON-EQUILIBRIUM THERMODYNAMICS, a periodical for international physics put out in America and West Germany, published a paper by Prof Istvan Kirschner, head of the low-temperature physics laboratory of the Lorand Eutvos University of Sciences. The paper was entitled "New Phase Transformation Resulting From Increased Additive Substance Content." Professor Kirschner realized that

when additives of some sort are added to superconductors, the latter lose their superconductivity once the ratio or concentration of the additive attains a certain value. This phenomenon occurs in reverse also. The experiments of the Hungarian researcher and his colleagues revealed that the right amount of the additive substance would cause abrupt and radical changes in physical properties. Of these changes, the most important are the electric, the magnetic and the thermal. Such rapid changes are known in physics as phase transformations. Usually such changes result from change in temperature. This latest discovery is of interest from three points of view: the realization that phase transformation can take place at a certain value of the ratio of the additive; the possibility of inducing or causing the discontinuation of superconductivity previously achievable only through temperature change or the use of external magnets; the fact that this radical change reveals that in some cases physical characteristics (electrical, magnetic, thermal, mechanical and crystallographic) can be enhanced more powerfully and sharply than previously known. This may make it possible to fabricate substance best suited to a specific purpose. [Budapest NEPSZABADSAG in Hungarian 25 Aug 77 p 9]

PAPER FOR OFFICIAL DOCUMENTS--The Paper Factory of Diosgyor has been in operation since before the turn of the century. Currently under the supervision of the First Hungarian Paper Industry, it employs 400 persons. Ferenc Kiszely, 40 years old, is the factory foreman. One special product of the factory, the personal identity card, is carefully guarded by all persons over the age of 14. The technology used to make the paper is a closely guarded secret. Not only the intricate pattern but the five-pointed star watermark make it impossible to counterfeit this paper. Under special lighting, the starry firmament appears on the pink paper. The red, yellow, blue and other fibers mixed into the paper actually phosphoresce. Only a few persons can know where and how many colored "stars" there are on the paper. Thus it is not only inadvisable but illegal to attempt to counterfeit it. Of the banknote paper made exclusively here, only the fact that it contains a certain percentage of rag is divulged. The factory has preserved this virtually obsolete technology which, though rarely used, greatly enhances the durability of paper. A similar, special process is used for basic material of passports and other official documents as well as sealed lottery tickets. [Budapest NEPSZABADSAG in Hungarian 26 Aug 77 p 4]

APPROVAL FOR CYCLOTRON PURCHASE--The presidium of the Hungarian Academy of Sciences supports the recommendation for the purchase of a 103-cm pole diameter cyclotron, because such an installation is both important and indispensable for applied research and the solution of practical problems. The presidium asks the first secretary of the academy, the chairman of the National Technical Development Committee and the president of the National Atomic Energy Committee to submit a joint proposal to the Science Policy Committee since the cost of acquiring the cyclotron will be in excess of 100 million forints. [Budapest AKADEMIAI KOZLONY in Hungarian 2 Aug 77 p 108]

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